

MPR 1152 performs the various multicast system functions (such as outlined for example by publication RFC 2236) such as processing multicast joins, leaves, queries and reports.

[0074] The multicast data output at 1158 may next pass through an AI (advertisement/content inserter) device 1153, where a "personalized" advertisement may be inserted into a particular virtual circuit (i.e., inserted advertisement content may be designated to reach only particular specific individual recipients depending, for example, on their demographic profile). Once the advertisement or other audio/video or streaming data content has been inserted, it enters vertical stack 1162 where appropriate encapsulation and ATM adaptation layer functionality is performed. Packets emerging protocol processing block 1162 (e.g., at 1164) are "full" packets that may be intermixed at the AAL5 level with packets at combiner 1166 input 1168 after arriving from the Internet and after protocol processing via stack 1170.

[0075] The output of combiner stage 1166 comprises packets of data in AAL5 format that can be presented to the lower layers of vertical stack 1184. One of ordinary skill in the art will recognize that both IGMP and multicast UDP packets may be properly processed in accordance with the functional diagram illustrated by FIGURE 14.

[0076] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

#### **What is claimed is:**

1. A method of providing IP multicast content to one or more recipients connected to a legacy ATM DSL network of the type using a conventional ATM switch for establishing one or more virtual circuits, comprising the steps of:

receiving an IP multicast signal from a multicast program source;

replicating predetermined data portions of the received IP multicast content;

converting an IP data stream from the IP multicast signal into a data stream conforming to ATM protocol, including performing appropriate data encapsulations and ATM adaptation layer processing for transmission of data over an ATM DSL network; and

providing the converted data stream to an ATM network switch for transmission to one or more recipient via one or more virtual circuits.

2. The method of claim 1 wherein the received IP multicast signal comprises a plurality of IP multicast content channels and said replicating step includes replicating one or more content channels.

3. The method of claim 1 further including a step of responding to an IGMP join request to provide and/or replicate one or more predetermined data portions of the received IP multicast content.

4. The method of claim 1 further including a step of responding to an IGMP leave request to terminate replicating and/or providing of one or more predetermined data portions of the received IP multicast content.

5. The method of claim 1 wherein the IP multicast signal comprises multiple multicast content channels and predetermined data portions comprise data packets corresponding to a particular IP multicast content channel and the step of replicating is performed in response to establishment of an ATM virtual circuit upon receipt of an IGMP join request.

6. The method of claim 1 further comprising a step of providing information indicating an IP multicasting group address associated with multicast content currently provided on a particular ATM virtual circuit.

7. The method of claim 1 further comprising a step of inserting advertisement content or other audio/video content into received IP multicast content, the advertisement or other content being inserted into a received IP multicast content stream at a location of a service provider of said ATM network prior to the step of converting an IP data stream from the IP multicast signal into a data stream conforming to ATM protocol.

8. The method of claim 1 wherein the IP multicast signal comprises multiple multicast content channels and further includes a step of controlling access of each content recipient with respect to particular content channels.

9. An IP ATM multicaster (IAM) apparatus for injecting IP multicast content into a legacy ATM network of the type using a conventional ATM switch, comprising:

a first data signal interface that receives IP multicast content data from an IP multicast content source;

a second data signal interface that provides ATM data cells to an ATM switch; and

a programmable processor programmed to convert received IP multicast content data into a data stream conforming to ATM protocol, including performing appropriate data encapsulations and ATM adaptation layer processing for transmission of data over an ATM DSL network for communication with customer premise equipment configured to operate using two or more ATM virtual circuits.

10. The IP ATM multicaster (IAM) apparatus of claim 9 further comprising a keyboard data input device connected to said processor and an output display device connected to said processor.

11. The IP ATM multicaster (IAM) apparatus of claim 9 further comprising a memory device connected to said processor for storing data and programming instructions.

12. The IP ATM multicaster (IAM) apparatus of claim 9 wherein the processor is connected to an Ethernet type communications bus and the first data signal interface

comprises a Ethernet network interface device for providing IP multicast content data to the processor.

13. The IP ATM multicaster (IAM) apparatus of claim 9 wherein the processor is connected to an Ethernet type communications bus and the second data signal interface comprises an Ethernet to ATM network interface device for providing ATM data cells from the processor to the ATM switch.

14. An ATM IP multicast inserter (AIMI) apparatus for injecting IP multicast content into an ATM network virtual circuit, comprising:

a first data signal interface that receives IP multicast content data from an IP multicast content source;

a second data signal interface that sends and receives ATM data cells to or from one or more ATM virtual circuits via an ATM switch and a digital subscriber line asynchronous multiplexer (DSLAM);

a third data signal interface that interfaces ATM data cells to a network router; and

a programmable processor programmed to convert received IP multicast content data into a data stream conforming to ATM protocol, including performing appropriate data encapsulations and ATM adaptation layer processing for transmission of data over an ATM DSL network for communication with customer premise equipment configured to operate using a single ATM virtual circuit.

15. An ATM IP multicast inserter (AIMI) apparatus as set forth in claim 14 wherein the processor is further programmed to replicate predetermined data portions of received IP multicast content.

16. The ATM IP multicast inserter (AIMI) apparatus of claim 14 further comprising an IP content inserter apparatus connected to the programmable processor for inserting predetermined local IP content into selected ATM virtual circuits prior to encapsulation and ATM adaptation layer processing.

17. The ATM IP multicast inserter (AIMI) apparatus of claim 14 wherein the processor is connected to an Ethernet type communications bus and the first data signal interface comprises a Ethernet network interface device for providing IP multicast content data to the processor.

18. In a point-to-multipoint IP content distribution system of the type using a satellite communications system to bypass congested portions of a digital communications network and having a satellite downlink receiver being positioned within an ISP, NSP or similar digital service network that provides or supplements the services of an ATM DSL network, an apparatus for providing IP multicast content to a conventional ATM switch used in a legacy ATM network to establish one or more ATM virtual circuits, comprising:

a programmable computer processor system having an internal digital data bus and including an interface for receiving an IP multicast content data stream from said receiver and an interface for providing ATM data cells to an ATM switch, said system programmed to convert a received IP multicast content data stream into a data stream conforming to ATM protocol, including performing appropriate data encapsulations and ATM adaptation layer processing for transmission of data over an ATM DSL network, wherein said apparatus acts as a bridge between multicast content distribution devices utilizing IP communications and multicast content distribution devices utilizing ATM communications.

19. The apparatus of claim 18 wherein said computer processor system includes a output display device and a keyboard for inputting data and/or programming instructions.

20. The apparatus of claim 18 wherein said interface for receiving an IP multicast content data stream from said receiver comprises an Ethernet network interface device.

21. The apparatus of claim 18 wherein said interface for providing ATM data cells to an ATM switch comprises an ATM network interface card.

22. The system of claim 18 wherein said apparatus for providing IP multicast content to said ATM switch is incorporated into said satellite downlink receiver.

23. The system of claim 18 wherein said apparatus for providing IP multicast content to an ATM switch is incorporated into an ATM switch.

24. The system of claim 18 further comprising a local content inserter device positioned within said ISP or NSP network and coupled to the IP multicast source and to said apparatus for providing IP multicast content to an ATM switch, wherein the local content inserter device inserts advertisement content or other audio/video content into a received IP multicast content stream before IP multicast content is provided to a said ATM switch.

25. The system of claim 24 wherein said local content inserter device comprises a programmable computer processor system having a memory device for storing at least portions of local audio/video content and includes an interface for communicating said local audio/video content to said apparatus for providing IP multicast content to an ATM switch.

26. The system of claim 25 wherein said portions of local audio/video content comprise one or more audio/video advertisements to be injected into said IP multicast stream.

27. The system of claim 24 wherein said local content inserter device is further connected to a separate billing and control processing system.

28. A method of providing IP multicast content to one or more recipients connected to a layer-2 ATM network of the type using a conventional ATM switch and a legacy DSLAM (Digital Subscriber Line Asynchronous Multiplexer) to distribute multicast content, comprising the steps of:

receiving an IP multicast signal from a multicast program source at a location of an ISP, NSP or similar digital service network that provides or supplements the services of an ATM DSL network;

converting the received IP multicast content data into a data stream conforming to ATM protocol, including performing appropriate data encapsulations and ATM adaptation layer processing for transmission of data over an ATM DSL network for communication

with customer premise equipment (CPE) configured to operate using two or more ATM virtual circuits; and

providing said data stream to said ATM switch.

29. The method of claim 28 wherein the step of providing said data stream to an ATM switch further comprises a step of providing said data stream to one or more digital subscriber line asynchronous multiplexers (DSLAM) for distribution to ATM DSL network customer premise equipment.

30. The method of claim 28 further comprising a step of inserting advertisement content or other audio/video content into received IP multicast content, the advertisement or other content being inserted into a received IP multicast content stream at a location of a service provider of said ATM network prior to the step of converting an IP data stream from the IP multicast signal into a data stream conforming to ATM protocol.

31. The method of claim 28 further comprising a step of replicating portions of received IP multicast content prior to said step of converting multicast content data into a data stream conforming to ATM protocol.

32. The method of claim 28 further comprising a step of inserting advertisement content or other audio/video content into predetermined replicated portions of received IP multicast content, wherein said predetermined replicated portions are provided to predetermined ATM virtual circuits.

33. A method of providing IP multicast content to one or more recipients connected to a layer-2 ATM network of the type using a conventional ATM switch and a legacy DSLAM (Digital Subscriber Line Asynchronous Multiplexer) to distribute multicast content, comprising the steps of:

receiving an IP multicast signal from a multicast program source at a location of an ISP, NSP or similar digital service network that provides or supplements the services of an ATM DSL network;

converting the received IP multicast content data into a data stream conforming to ATM protocol, including performing appropriate data encapsulations and ATM adaptation layer processing for transmission of data over an ATM DSL network for communication with customer premise equipment (CPE) configured to operate using a single ATM virtual circuits; and

providing said data stream to said ATM switch.

34. The method of claim 33 wherein the step of providing said data stream to an ATM switch further comprises a step of providing said data stream to one or more digital subscriber line asynchronous multiplexers (DSLAM) for distribution to ATM DSL network customer premise equipment.

35. The method of claim 33 further comprising a step of inserting advertisement content or other audio/video content into received IP multicast content, the advertisement or other content being inserted into a received IP multicast content stream at a location of a service provider of said ATM network prior to the step of converting an IP data stream from the IP multicast signal into a data stream conforming to ATM protocol.

36. The method of claim 33 further comprising a step of replicating portions of received IP multicast content prior to said step of converting multicast content data into a data stream conforming to ATM protocol.

37. The method of claim 36 further comprising a step of inserting advertisement content or other audio/video content into predetermined replicated portions of received IP multicast content, wherein said predetermined replicated portions are provided to predetermined ATM virtual circuits.